PROBLEMS AND SOLUTIONS.

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PROBLEMS FOR SOLUTION.

ALGEBRA.

471. Proposed by E. T. BELL, University of Washington.

If there is an infinite number of positive integers r for which the equation $\sum_{i=1}^{n} a_i^r = \sum_{i=1}^{m} b_i^r$ holds, where the a_i and b_i are given positive integers, prove that $m = n$, and that in some order the a_i are identical with the b_i.

472. Proposed by E. T. BELL, University of Washington.

If a_i and b_j $(i = 1, \cdots, n;\ j = 1, \cdots, m)$ denote positive integers, and if $\sum_{i=1}^{n} a_i^r = \sum_{j=1}^{m} b_j^r$ for all odd positive integral values of r, prove that $m = n$, and that in some order the a_i are identical with the b_j.

GEOMETRY.

503. Proposed by J. W. CLAWSON, Ursinus College, Penn.

If two points A and B invert with respect to a third point O as center of inversion into A' and B', the middle point of the segment AB inverts into the point other than where the circle of Apollonius (the locus of a point P moving so that $A'P/PB' = A'O/OB'$) cuts the circle $OA'B'$.

504. Proposed by NATHAN ALTSHILLER, University of Oklahoma.

The base of a variable triangle is fixed, the opposite vertex describing a given line. Find the envelop of the side of the pedal triangle opposite the moving vertex.

CALCULUS.

419. Proposed by C. C. YEN, Tangshan, North China.

Find the entire area of the surface $x^{2/3} + y^{2/3} + z^{2/3} = a^{2/3}$.

420. Proposed by W. J. GREENSTREET, Stroud, England.

The join of the center of curvature of a curve to the origin is at an angle α to the initial line. Prove that with the usual notation,

$$\frac{d\alpha}{d\psi}\left[\left(\frac{dp}{d\psi}\right)^2 + \left(\frac{d^2p}{d\psi^2}\right)^2\right] = \frac{dp}{d\psi}\cdot\frac{d\rho}{d\psi}.$$

MECHANICS.

336. Proposed by C. N. SCHMALL, New York City.

An inclined plane, length l, makes an angle $\phi(< \pi/4)$ with the horizontal plane through its foot. From its foot, a body is projected upward along the plane, with a velocity equal to that of a falling body at the height h, so as to pass over the top and strike the horizontal plane at the *maximum distancex* from the foot of the inclined plane. Show by the methods of the calculus that $x = h/\sin\phi\cos\phi$, and that the corresponding value of l is $2h\cot 2\phi/\cos\phi$.

337. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Assuming that a train may be accelerated by the application of a force equal to 1/40 of its gross weight and be braked with a force equal to 1/10 of its gross weight, show that the least time in which it may run from one to another of two stopping stations 5,000 feet apart is 2 minutes and 5 seconds. Also find the greatest speed during the run to be 54-6/11 miles per hour.